Atlantic Oceanographic and Meteorological Laboratory

Update on the USWRP Observing System Simulation Experiment (OSSE) Testbed

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Participating organizations: AOML, ESRL, NSSL, ARL, JCSDA, CIMSS

Collaborating organizations: NASA GSFC and JPL

OSSE Team members and collaborators

Hurricane OSSE Team: S. Murillo, L. Bucci, A. Aksoy,J. Delgado, B. Annane, R. Hoffman S. Majumdar, B. McNoldy, D. Nolan

Ocean OSSE Team: , G. Halliwell, V. Kourafalou

OAR OSSE collaborators: L. Cucurull, Z. Toth, H. Wang, P. Lee

JCSDA OSSE collaborators: S. Boukabura, S. Casey, J. Yoe, J. Woolen

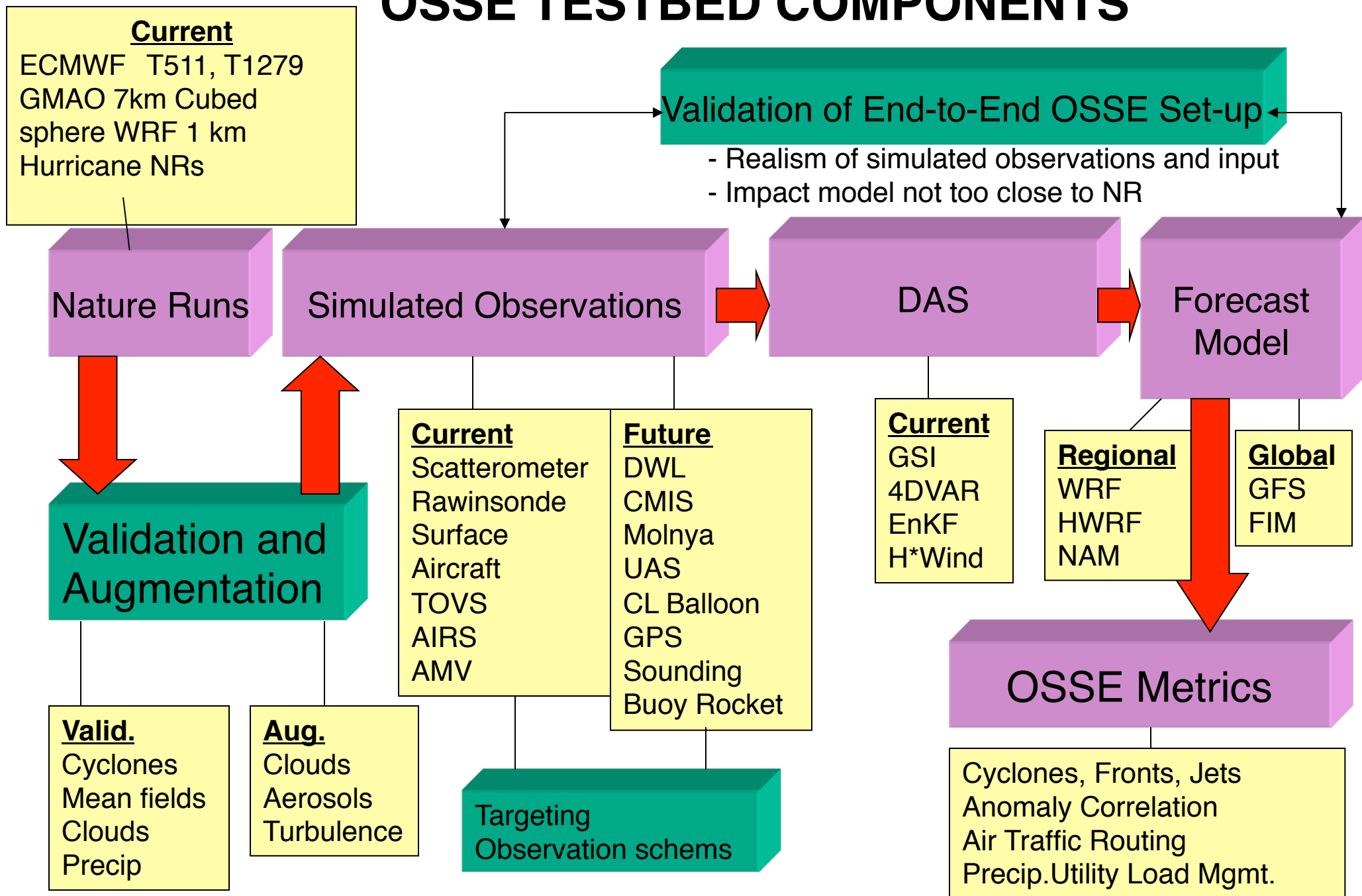**NASA collaborators:** J. Susskind, T. Pagano, B. Lambrigtsen, W. Putman

Primary Objective

To establish a numerical test bed that would enable a hierarchy of experiments to:

(1) determine the potential impact of proposed space-based, sub-orbital, and in situ observing systems on analyses and forecasts,

(2) evaluate trade-offs in observing system design, and

(3) assess proposed methodology for assimilating new observations in coordination with the Joint Center for Satellite Data Assimilation (JCSDA).

Sub-objectives

(1) To define both the advantages and limitations of a hierarchy of OSSEs that includes rapid prototyping of instrument or data assimilation concepts, as well as the more rigorous "full" OSSEs.

(2) To generate an OSSE/OSE process that invites participation by the broad community of agency planners, research scientists and operational centers.

OSSE TESTBED COMPONENTS

Current
ECMWF T511, T1279
GMAO 7km Cubed
sphere WRF 1 km
Hurricane NRs

Validation of End-to-End OSSE Set-up
- Realism of simulated observations and input
- Impact model not too close to NR

Nature Runs

Simulated Observations

DAS

Forecast Model

Validation and Augmentation

Current
Scatterometer
Rawinsonde
Surface
Aircraft
TOVS
AIRS
AMV

Future
DWL
CMIS
Molnya
UAS
CL Balloon
GPS
Sounding
Buoy Rocket

Current
GSI
4DVAR
EnKF
H*Wind

Regional
WRF
HWRF
NAM

Global
GFS
FIM

Valid.
Cyclones
Mean fields
Clouds
Precip

Aug.
Clouds
Aerosols
Turbulence

Targeting
Observation schems

OSSE Metrics

Cyclones, Fronts, Jets
Anomaly Correlation
Air Traffic Routing
Precip.Utility Load Mgmt.

Science Priorities for FY 15/16

1. To develop a new next-generation global OSSE system to replace the current T511OSSE system in use at ESRL and JCSDA.

2. To develop and/or expand regional OSSE capabilities for hurricanes, severe local storms and air quality.

3. To conduct OSSEs to assess the potential impact of GNSS RO constellations, Geo Hyperspectral IR and microwave sounders, doppler wind lidar, and to answer other high priority observing system questions being considered by NOAA and its partners.

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Procedure for Selecting OSSEs to be performed

- **Candidates for OSSEs are proposed by representatives from each of NOAA's line offices.**

- **For each proposed assessment topic/question we then answer the following questions and assign a priority:**

  Question 1: Is there a pressing need for the assessment to be executed in FY15/16? [Yes/No]

  Question 2: Does NOAA currently have the capabilities in place to execute the assessment in FY15/16? [Yes/No]

  Question 3: Are there existing resources available in FY15 for the assessment? [Yes/No] Estimate the amount needed/or additional above existing $ [$k]

  Question 4: Can the assessment be completed in FY15/16? [Yes/No]

  Question 5: Potential value to NOAA and partners? [High, Medium, Low]

Priority Tiers

Priority Tier 1: Has Pressing need for immediate execution

- 1A: All factors align; need, $, capability, FY15 finish, high value

- 1B: All but 1 factor align; Need, capability, $, FY15 finish, yet lower value

- 1C: Need and high value, yet no capability or $

- 1D: Need, yet medium value and no capability or $ available.

Priority Tier 2: No pressing need for immediate execution yet capability exists (may need $)

- 2A: At least 2 other factors align

- 2B: 1 factor aligns and medium+ value

- 2C: 1 factor aligns

Priority Tier 3: No pressing need, capability, nor resources

- 3A: High value

- 3B: Medium-Low value

FY 14 Accomplishments

1. Provided expertise on OSSEs to NOAA, partners and academia.

2. Substantial progress toward the development of the next-generation global OSSE system has occurred. This includes the generation and validation of a new global nature run at 7 km resolution and the simulation of observations. (JCSDA, NASA GMAO, AOML, ESRL, and CIMSS).

3. The regional Hurricane OSSE system and the regional Ocean OSSE system have been expanded. (AOML and RSMAS)

4. Progress has been made toward the development of new regional OSSE systems for severe local storms and air quality. (NSSL, ARL, and AOML)

FY 14 Accomplishments (continued)

5. Preliminary global and regional OSSEs using the earlier T511 OSSE system were conducted to evaluate the potential impact of GNSS RO, Geo hyperspectral sounders, wind lidar, UAS, CYGNSS, and CYMISS on numerical weather prediction. Results from these experiments were reported to NOAA leadership, NASA, and Congress.(AOML, ESRL, JCSDA, CIMSS and NASA)

6. New OSSEs to address hurricane predictability issues were initiated. The initial experiments focused on the "spindown effect" which typically occurs whenever a strong hurricane is initialized in regional models. (AOML and RSMAS)

7. Presented results at AMS Annual Meeting, AMS Hurricane Conference, and two International Conferences.

Activities for FY 15 and 16

1. Complete the development of the next generation global OSSE system.

2. Begin in FY 15 and complete in FY 16 OSSEs to evaluate GNSS RO, Geo hyperspectral sounders, CYGNSS, doppler wind lidar, and UAS using the new global OSSE system and the enhanced regional OSSE capabilities.

3. Investigate targeting observation schemes for UAS and other observing systems.

4. Begin development of new OSSE capabilities for other line offices

Snapshot from GMAO 7km resolution global nature run